

FORM PTO-1390  
(REV 12-29-99)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEYS DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

09/582890

INTERNATIONAL APPLICATION NO.

PCT/PL98/00052

INTERNATIONAL FILING DATE

December 31, 1998

PRIORITY DATE CLAIMED

January 19, 1998

TITLE OF INVENTION

POWER OPERATED PISTON TOOL WITH PISTON AUTOMATIC RETURN

APPLICANT(S) FOR DO/EO/US

Łagodziński Marek, Łagodzińska Bogusława, Rogowski Zbigniew

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11. to 16. below concern document(s) or information included:**

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.  
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:  
A translation of Prior Foreign Application P-324361  
A copy of US Patent No. 3,331,546  
A copy of EP Patent No. 0 223 740  
A Certified Copy of Prior Foreign Application P-324361  
An International Preliminary Examination Report  
STATEMENT CLAIMING SMALLENTITY STATUS

07 JUL 2000

17. ☒ The following fees are submitted:**BASIC NATIONAL FEE (37 CFR 1.492 (a)(1) - (5)) :**

Neither international preliminary examination fee (37 CFR 1.482)  
nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO  
and International Search Report not prepared by the EPO or JPO ..... \$970.00

International preliminary examination fee (37 CFR 1.482) not paid to  
USPTO but International Search Report prepared by the EPO or JPO. .... \$840.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but  
international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$690.00

International preliminary examination fee paid to USPTO (37 CFR 1.482)  
but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$670.00

International preliminary examination fee paid to USPTO (37 CFR 1.482)  
and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$96.00

**ENTER APPROPRIATE BASIC FEE AMOUNT =****CALCULATIONS** PTO USE ONLY

\$ 840.00

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30  
months from the earliest claimed priority date (37 CFR 1.492(e)).

\$

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	20 - 20 =	0	X \$18.00
Independent claims	3 - 3 =	0	X \$78.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$260.00

\$

\$

\$

**TOTAL OF ABOVE CALCULATIONS =**

\$ 840.00

Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement  
must also be filed (Note 37 CFR 1.9, 1.27, 1.28).

\$ 420.00

**SUBTOTAL =**

\$ 420.00

Processing fee of \$130.00 for furnishing the English translation later than ☐ 20 ☐ 30  
months from the earliest claimed priority date (37 CFR 1.492(f)).

\$

+

**TOTAL NATIONAL FEE =**

\$ 420.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be  
accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property

\$

+

**TOTAL FEES ENCLOSED =**

\$ 420.00

Amount to be

refunded:

\$

charged:

\$

a. ☒ A check in the amount of \$ 500.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. \_\_\_\_\_ in the amount of \$ \_\_\_\_\_ to cover the above fees.  
A duplicate copy of this sheet is enclosed.

c. ☐ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any  
overpayment to Deposit Account No. \_\_\_\_\_. A duplicate copy of this sheet is enclosed.

**NOTE:** Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR  
1.137(a) or (b)) must be filed and granted to restore the application to pending status. June 30 2000 June 30 2000

SEND ALL CORRESPONDENCE TO: Mr. Mirosław Paczuski  
PATRADE Int'l

2240 S. Lumber St.

Allentown, PA 18103

SIGNATURE

Kagodziński Marek

NAME

REGISTRATION NUMBER

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

**STATEMENT CLAIMING SMALL ENTITY STATUS  
(37 CFR 1.9(f) & 1.27(b))--INDEPENDENT INVENTOR**

Docket Number (Optional)

Applicant, Patentee, or Identifier Łagodziński Marek, Łagodzińska

Application or Patent No. Bogusława, Rogowski Zbigniew

Filed or Issued: \_\_\_\_\_

Title POWER OPERATED PISTON TOOL WITH PISTON AUTOMATIC RETURN

As a below named inventor, I hereby state that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in

☒ the specification filed herewith with title as listed above.

☐ the application identified above

☐ the patent identified above

I have not assigned, granted, conveyed, or licensed, and am under no obligation under contract or law to assign, grant, convey, or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e)

Each person, concern, or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below.

☒ No such person, concern, or organization exists

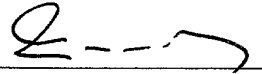
☐ Each such person, concern, or organization is listed below

Separate statements are required from each named person, concern, or organization having rights to the invention stating their status as small entities (37 CFR 1.27)

I acknowledge the duty to file in this application or patent notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate (37 CFR 1.28(b))

Łagodziński Marek


NAME OF INVENTOR

  
Signature of inventor

30. June 2000  
Date

Łagodzińska Bogusława

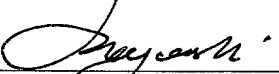
NAME OF INVENTOR

  
Signature of inventor

30. June 2000  
Date

Rogowski Zbigniew

NAME OF INVENTOR

  
Signature of inventor

30 June 2000  
Date

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Łagodziński Marek et al.

Title: POWER OPERATED PISTON TOOL WITH PISTON AUTOMATIC RETURN

International Application No.: PCT/PL98/00052

International Filing Date: 31 December 1998

June 30, 2000

**FIRST PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents

BOX PCT

Washington, D.C. 20231

SIR:

This is the first preliminary amendment to provide certain corrections in the above captioned patent application. Applicants petition that, if required, the time for response be extended and the corresponding fee be charged. Applicants further respectfully request that this response be accepted as a bona fide effort to meet any potential response requirements outstanding and due in the above captioned matter.

Please amend the application as follows:

**IN THE SPECIFICATION:**

Page 1, before line 5, please insert

**-- BACKGROUND OF THE INVENTION**Field of the Invention--.

Page 1, line 5, please delete „The object of this invention is” and substitute therefor –The present invention relates to--.

Page 1, after line 6, please insert

**-- 2. Brief Description of the Background of the Invention**

Including Prior Art--.

Page 1, line 14, please delete „that is piston shank tip” and substitute therefor –that its piston tip--.

Page 2, after line 54, insert

**-- SUMMARY OF THE INVENTION**

1. Purposes of the Invention--.

Page 2, line 58, after „one-piece elastic returning bush.” please insert

-- It is another object of the present invention to provide for a power operated piston tool in which a piston is correctly positioned in its initial position after firing.

These and other objects and advantages of the present invention will become evident from the description which follows.

2. Brief Description of the Invention

The present invention provides for a power actuated piston tool for driving fasteners into a base like masonry, concrete, wood. A power actuated piston tool with an automatic piston return is composed of an external barrel with a guiding barrel and a guide fastener and a piston means moveably mounted in the guiding barrel and the fastener guide. The piston means is formed of a piston shank inserted in the fastener guide and a piston head guided in the guiding barrel.--.

Page 2, line 60, please delete „bellow” and substitute therefor –bellows--.

Page 3, after line 93, please insert

-- The novel features which are considered as characteristic for the invention are set forth in the appended claims.

**BRIEF DESCRIPTION OF THE DRAWINGS--**

Page 4, after line 104, please insert

**--DESCRIPTION OF INVENTION AND PREFERRED EMBODIMENT--.**

Page 4, line 111, please delete „bellow” and substitute therefor –bellows--.Page 5, line 136, please delete „guiding bush” and substitute therefor –guiding barrel--.

Page 5, line 150, please delete „silencer 11” and substitute therefor –silencer 81--.

Page 7, line 187, please delete „fastener 7” and substitute therefor –fastener 6--.

Page 7, after line 200, please insert

-- It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of piston tools differing from the types described above.

While the invention has been illustrated and described as embodied in the context

of a power actuated piston tool with an automatic piston return, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims. --

#### **IN THE CLAIMS:**

3. (amended) A power actuated piston tool, according to claim [1 or] 2, wherein the maximal internal diameter (D4) of at least one segment of the returning bush (7) at its both ends, is of smaller size than respective diameter (D2) of the remaining segments.
4. (amended) A power actuated piston tool, according to claim [1 or] 2, wherein the end segment walls of returning bush (7) are thicker than other segment walls.
5. (amended) A power actuated piston tool, according to claim [1 or] 2, wherein the internal end surface of external segments of returning bush (7) is markedly curved outside in such a way, that the position of curvature points (71) is clearly distanced from the returning bush (7) face (72).
6. (amended) A power actuated piston tool, according to claim [1or] 2, wherein the length of the returning bush (7) is selected in such a way, that after initial blocking, the piston shank (1) end face does not reach its extreme forward position and remains at a distance from the base (30), the distance greater than the head height of fastening element (6).
7. (amended) A power actuated piston tool, according to claim [1or] 2, wherein the maximal external diameter (D1) of the returning bush (7) is smaller enough than the internal diameter of the guiding barrel (2), that after initial blocking of the returning bush (7), its external diameter still remains smaller than the internal diameter of the guiding

bush (2), thus preserving the small clearance.

8. (new) A power operated piston tool with a piston automatic return comprising  
an outer barrel having a firing chamber at a first end;  
a guiding barrel mounted in the outer barrel;  
a fastener guide having an outer surface at a thin end and mounted at a thick part in the  
guiding barrel and with the thin end standing out from the outer barrel;  
a piston provided with a piston head placed in the guiding barrel and a piston shank  
inserted in the fastener guide wherein the piston is movably positioned between a firing  
position and a fastening position;  
a firing-pin assembly mounted at the first end of the outer barrel; and  
a bellowslike hollow element for an automatic return of the piston from the fastening  
position to the firing position and situated on the piston shank between the piston head  
and the fastener guide and made of elastomeric material wherein an outer diameter of  
the bellowslike hollow element and an internal diameter of the bellowslike hollow element  
are regularly varied creating uniformly spaced swellings and narrowings running circularly  
on an outer surface and an inner surface of the bellowslike element and wherein between  
each two neighboring narrowings is formed a segment with a sinusoidal or a frusta-  
spherical or a frusta-conical or a barrel wall contour.

9. (new) The power operated piston tool according to claim 8, wherein a maximal  
inner diameter of at least one said segment of the bellowslike hollow element at its both  
ends is smaller than an inner diameter of remaining segments.

10. (new) The power operated piston tool according to claim 8, wherein walls of outer  
segments of the bellowslike hollow element are thicker than walls of inner segments.

11. (new) The power operated piston tool according to claim 8, wherein an inner end  
surface of outer segments of the bellowslike hollow element is outwardly curved.

12. (new) The power operated piston tool according to claim 8, wherein a sum of wall  
thickness of all segments of the bellowslike hollow element and a length of the fastener  
guide is slightly larger than a sum of a length of the piston shank and a thickness of a

fastener head thereby a piston shank end face is distanced from the outer surface of the fastener guide slightly more than the thickness of the fastener head in an initial blocking position of the piston.

13. (new) A power operated piston tool with a piston automatic return comprising an outer barrel having a firing chamber at a first end;  
a guiding barrel mounted in the outer barrel;  
a fastener guide having an outer surface at a thin end and mounted at a thick part in the guiding barrel and with the thin end standing out from the outer barrel;  
a piston provided with a piston head placed in the guiding barrel and a piston shank inserted in the fastener guide wherein the piston is movably positioned between a firing position and a fastening position;  
a firing-pin assembly mounted at the first end of the outer barrel; and  
a one-piece hollow element formed of segments and situated on the piston shank between the piston head and the fastener guide and made of elastomeric material wherein a sum of a length of the fastener guide and a length of the one-piece hollow element in a state when wall surfaces of neighboring segments of the one-piece element are in an introductory contact is slightly larger than a sum of a length of the piston shank and a thickness of a fastener head thereby a piston shank end face is distanced from the outer surface of the fastener guide slightly more than the thickness of the fastener head in an initial blocking position of the piston.

14. (new) The power operated piston tool according to claim 13, wherein a wall of each segment of the segments of the one-piece hollow element has a sinusoidal profile.

15. (new) The power operated piston tool according to claim 13, wherein a wall of each segment of the segments of the one-piece hollow element has a frustum of sphere profile.

16. (new) The power operated piston tool according to claim 13, wherein a wall of each segment of the segments of the one-piece hollow element has a frustum of a cone profile.



17. (new) The power operated piston tool according to claim 13, wherein a wall of each segment of the segments of the one-piece hollow element has a barrel profile.

18. (new) The power operated piston tool according to claim 13, wherein a wall of each segment of the segments of the one-piece hollow element has a frustum of barrel profile.

19. (new) The power operated piston tool according to claim 13, wherein an inner end surface of outer segments of the one-piece hollow element is outwardly curved.

20. (new) The power operated piston tool according to claim 13, wherein walls of outer segments of the one-piece hollow element are thicker than walls of inner segments.

#### REMARKS

Claims 1 – 7 were in the application. New claims 8 –20 are being added.

The language of the new claims is based on the language of the original claims as follows:

New claims	Original claims
8, 13	1
9	3
10	4
11	5
12	6
14	2
15	2
16	2
17	2
18	2
19	5
20	4

This First Preliminary Amendment is submitted in order to obviate the multiple dependency of the claims of the International Application PCT/PL98/00052 and to clarify the language of the specification and the claims.

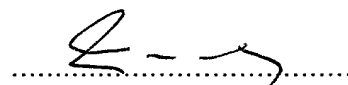
Entry of the above recited corrections prior to calculation of the filing fee is respectfully requested.

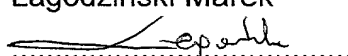
Respectfully submitted by applicants and inventors:

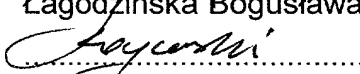
Łagodziński Marek, ul. Ćwiklińskiej 2 m 19, 92-508 Łódź, Poland

Łagodzińska Bogusława, ul. Ćwiklińskiej 2 m 19, 92-508 Łódź, Poland

Rogowski Zbigniew, ul. Dąbrówki 17 m 25, 92-413 Łódź, Poland

 30 June 2000

Łagodziński Marek  
 30 June 2000

Łagodzińska Bogusława  
 30 June 2000  
Rogowski Zbigniew

Power operated piston tool with  
piston automatic return

5       The object of this invention is a power operated piston tool with piston automatic return

      In power operated piston tools, of indirect action, designed for driving fastening elements into a base like masonry, concrete, wood or the like, a piston element, driven by firing  
10   gases, coming from firing cartridge, is used as an intermediary element, acting upon the fastener, as opposite to tools of direct action, where firing gases act directly upon fastening element.

      In tools of indirect action, the piston after fastening is in its forward position, that is piston shank tip is at the fastener  
15   guide muzzle end. In order to return the piston to its firing position, in conventional, semiautomatic tools, manual reloading is required. This reloading consists of pulling backward the barrel means, having a returning tooth, engaging the respective cavity on piston means, which causes the piston to return. This  
20   operation is also used to shift the firing cartridge belt about one position, thus making the tool ready for next firing.

      In other kind of power piston tools, described in patent EP 0223740, the piston return is actuated by the firing gases, which, after pushing the piston to its forward position, while still  
25   expanding, cause the piston to retract. However, after retracting, the piston strikes against its rear abutment, thus causing the reflection effect, which may displace the piston of some distance from its firing position, creating a dead space, decreasing the firing power of a subsequent fire. As a result,  
30   fasteners are driven into the base at uneven depth and the firing chamber becomes spoiled with firing remains, due to incomplete

burning of blowing charge. Besides, problems can occur when the piston itself is driven into the base after fastening operation. In that case, to return the piston to its firing position, an additional manual push-rod is needed. In any case, after transporting or other periods of prolonged disuse of the tool, it is always useful to check with manual push-rod, whether the piston is well in its firing position, the only one initial position ensuring tool correct functioning.

In another kind of power piston tool, illustrated in US patent No 3,331,546, to return the piston member, a plurality of stacked washers constructed from polyurethane elastomer, are applied. The washers are positioned within the barrel, on the piston shank. After firing the washers are rapidly collapsed, thus absorbing part of firing energy and functioning as a buffer. At the end of power stroke, and after dissipation of the firing gases, escaping through vent holes in the barrel, the washers will return to their original shape, due to elastic memory, and thus they return piston to its firing position. The venting holes, situated in washers' side portions cause stress concentration and thus damage to spring elements. The other problem arises when exchanging worn-out washer elements, as they require strictly defined positions and quantity, otherwise malfunction may occur, if not a serious tool damage.

It is an object of this invention to provide a power operated piston tool, free from above mentioned imperfections, in which the piston return is carried-out mechanically, by use of one-piece elastic returning bush. The returning bush is situated on piston shank between piston head and fastener guide, is made of elastomeric material and has a shape of bellow, whose diameters both external and internal are regularly varied. The walls of so formed returning bush are approximate in shape to a

sinusoid, or to a stack of frusto-spherical segments, or frusto-conical segments, or stack of barrel-shape segments or/and  
65 other surface of revolution segments, creating uniformly spaced swellings and narrowings of wave like structure.

The returning bush according to this invention advantageously has the maximal internal diameter of at least one segment at its both ends of slightly smaller size than the  
70 respective diameter of remaining segments, so the end segment walls are thicker than others segment walls.

The internal end surface of external segments is markedly curved outside in such a way, that the position of curvature points of bush ends is clearly distanced from bush face. The  
75 length of returning bush is selected in such a way that after initial blocking, the piston shank end face does not reach its extreme forward position and remains at a distance from the base, the distance slightly greater than the head height of fastening element. The maximal external diameter of returning  
80 bush according to present invention is smaller enough than the internal diameter of guiding barrel, that, after initial blocking of the bush, its external diameter still remains smaller than internal diameter of guiding bush, thus preserving the slight clearance.

85 After driving fully the fastening element into the base, and subsequent stopping the piston movement, the energy accumulated in the returning bush is being relieved and rejects the piston to the rear, due to shape memory of elastomeric material. It is the first and the greatest returning force acting  
90 upon the piston. After returning the piston to its rear position, there remains some slight force due to not fully recovering the bush free shape, which force retains the piston in its rear position that is firing position.

The object of this invention is illustrated in a preferable  
 95 embodiment in the accompanying drawings in which fig 1 is a  
 longitudinal cross sectional view of the power piston tool,  
 showing the piston in its firing position, at the moment of firing  
 the cartridge, fig 2 is the same view showing the piston at the  
 end of normal power stroke, at the moment of driving the  
 100 fastening element into a base, after initial blocking of returning  
 bush, fig 3 is the same view after driving the fastening element  
 fully into the base, fig 4 is the cross sectional view of middle  
 part of the returning bush and fig 5 is somewhat enlarged view  
 of one of returning bush end in cross section.

105 In power tool shown in fig 1 a piston 1, mounted for  
 reciprocation within the guiding barrel 2, is in its firing position  
 at the rear end of the barrel 2 where the piston head 12 is, as  
 near, as possible, to the firing chamber 4. On piston shank 11,  
 between the piston head 12 and fastener guide 5 an elastic  
 110 returning bush 7 is situated, being in the shape of one piece  
 bellow, constructed from an elastomer, whose diameters both  
 external and internal are regularly varied. The walls of so  
 formed returning bush 7 are approximate in shape to a stack of  
 frusto-spherical segments, creating uniformly spaced swellings  
 115 and narrowings of wave like structure. In another embodiment of  
 the invention the returning bush is of shape of stack of frusto-  
 conical segments. In yet another embodiment of the invention,  
 the returning bush is of shape of the stack of barrel shape  
 segments or/and another surface of revolution segments. The  
 120 returning bush 7 has the maximal internal diameter D4, of its  
 extreme two segments at its both ends, of slightly smaller size  
 than the respective diameter D2 of remaining segments, so that  
 the bush end segment walls are a little thicker than other  
 segments walls. The internal end surface of external segments

125 is markedly curved outside in such a way, that the position 71 of  
 curvature points of bush ends is clearly distanced from the bush  
 faces 72. The length of the returning bush 7 is selected in such  
 a way that after initial blocking of the returning bush 7, the  
 piston shank 1 end face does not reach its extreme forward  
 130 position and remains at a distance from the base 30, the  
 distance slightly greater than the head height of fastening  
 element 6. The maximal external diameter D1 of the returning  
 bush 7 is smaller enough than the internal diameter of the  
 guiding barrel 2, that, after initial blocking of the returning bush  
 135 7, its external diameter still remains smaller than internal  
 diameter of the guiding bush 2, thus preserving a slight  
 clearance. When the piston 1 is in its firing position, an initial  
 stress within the returning bush 7 remains, enough to ensure  
 that the piston head 12 abuts the bottom of the barrel 2, near  
 140 the firing chamber 4. On the piston head 12 there is a plurality  
 of grooves 121, acting as sealing means for firing gases and  
 providing some space to gather impurities. Ports A in the  
 guiding barrel 2 and ports B and C in external barrel 8 are  
 provided to enable the firing gases evacuation after firing.  
 145 After firing the cartridge 9 upon striking the firing pin 20,  
 the firing gases set the piston 1 into motion, with rapidly  
 accelerating velocity, towards the fastener 6. Piston head 12,  
 after passing the port A, opens gas flow connection toward the  
 space between the guiding barrel 2 and external barrel 8 and  
 150 from there, through port B, toward silencer 11, and from there,  
 via port C, into the atmosphere, thus reducing the firing noise  
 and gas pressure in firing chamber, to value close to  
 atmospheric pressure. Accelerated piston 1 strikes against  
 fastener 6, driving it into base 30, and at the same time,  
 155 compressing the returning bush 7. At a distance of several

millimeters before fully setting the fastener 6 into the base 30  
 initial blocking of the returning bush 7 takes place. In this  
 position the piston shank 1 and face does not reach its extreme  
 forward position and remains at some distance from the base 30  
 160 slightly greater than the head height of fastener 6 and a  
 clearance exists between the guiding barrel 2 and returning  
 bush 7. The returning bush 7, at the final stage of the piston 1  
 motion, forms a shut tubular column ,thus absorbing little firing  
 energy which ensures driving the fastening element 6 to the full  
 165 depth. In the event of free flight shot or overdrive of the piston,  
 this shut tubular column will function as a buffer, to absorb the  
 high energy of the piston 1 .

After thrusting the fastener 6 into the base 30, the piston 1  
 stops and due to elastic memory, inherent in elastomeric  
 170 material, the returning bush 7 will return the piston 1 to its firing  
 position, where it is ready for the next firing operation, the more  
 easier that the counter-pressure acting upon the piston 1 from  
 the firing chamber 4, has fallen to atmospheric pressure.

To reload the power piston tool, it should be removed from  
 175 the contact with the base 30 , then the springs of firing-pin  
 assembly move the subassembly of piston 1 and its guiding  
 barrel 2 forward, about a stroke, enabling : first to remove the  
 used firing cartridge 9 from the firing chamber 4 and, secondly,  
 after the tool is pressed anew against base 30 for the  
 180 subsequent firing, to shift the cartridge belt 40 about one  
 position.

By virtue of particular configuration of the elastic returning  
 bush 7, during the normal power stroke, substantially little  
 energy will be absorbed by the returning bush 7 being pressed,  
 185 and thus there will be little interference with the velocity of the  
 piston 1, so the bulk of firing energy is used for driving the



fastener 7 into base 30, while only small portion of this energy will be used for returning the piston 1 to its firing position, thus reducing the tool reflection effect and ensuring that the piston 1,  
190 will always return to its firing position, after venting the space behind its head 12. The particular wave like shape of returning bush 7, as well as, thickening the bush 7 end segments and particular position of curvature points of bush 7 ends ensures correct functioning of the tool and eliminates the elastomeric  
195 bush tendency to curl, which tendency could drive to a situation when the piston 1 could be blocked within the guiding barrel 2. Besides, the returning bush 7 does not oppose a great resistance to the piston 1 movement, so it does not brake its velocity and it does not impair the effectiveness of fastening the  
200 fasteners and does not provoke any tool reflection effect.

## Claims

1.A power actuated piston tool with piston automatic return, comprising an external barrel with a guiding barrel  
5 situated there within, a piston means mounted for reciprocation within said guiding barrel, between firing position and fastening position, a firing-pin assembly, situated at the rear end of external barrel, operatively connected therewith, and means for automatic return of piston means from its fastening position to  
10 its firing position, situated on piston shank between piston head and fastener guide, said means for automatic piston return is a one-piece elastic returning bush (7) made of elastomeric material in the shape of bellow, whose diameters both external and internal are regularly varied. creating uniformly spaced  
15 swellings and narrowings of wave like structure.

2.A power actuated piston tool, according to claim 1, wherein the walls of returning bush (7) are approximate in shape to a sinusoid, or to a stack of frusto-spherical segments, or to a stack of frusto-conical segments, or to a stack of barrel  
20 shape segments and/or other surface of revolution segments.

3.A power actuated piston tool, according to claim 1 or 2 , wherein the maximal internal diameter (D4) of at least one segment of the returning bush (7) at its both ends , is of smaller size than respective diameter (D2) of the remaining segments.

25 4.A power actuated piston tool, according to claim 1 or 2, wherein the end segment walls of returning bush (7) are thicker than other segment walls.

5. A power actuated piston tool, according to claim 1 or 2, wherein the internal end surface of external segments of  
30 returning bush (7) is markedly curved outside in such a way, that the position of curvature points (71) is clearly distanced from the returning bush (7) face (72).

6. A power actuated piston tool, according to claim 1 or 2, wherein the length of the returning bush (7) is selected in such a way, that after initial blocking, the piston shank (1) end face does not reach its extreme forward position and remains at a distance from the base (30), the distance greater than the head height of fastening element (6).

7. A power actuated piston tool, according to claim 1 or 2, wherein the maximal external diameter (D1) of the returning bush (7) is smaller enough than the internal diameter of the guiding barrel (2), that after initial blocking of the returning bush (7), its external diameter still remains smaller than the internal diameter of the guiding bush (2), thus preserving the small clearance.

## Abstract of the Disclosure

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The present invention provides a defect-less and easy to operate power actuated piston tool with automatic piston return, designated for driving fasteners into a base like masonry, concrete, wood or the like.

10

The tool according to the invention is characterized by that on piston shank (11) of piston (1), there is an elastic returning bush (7), situated between piston head (12) and fastener guide (5), said returning bush (7) is a one-piece in shape of bellow, made of elastomeric material, of regularly variable diameter.

15

(Fig. 1)

( 7 claims)

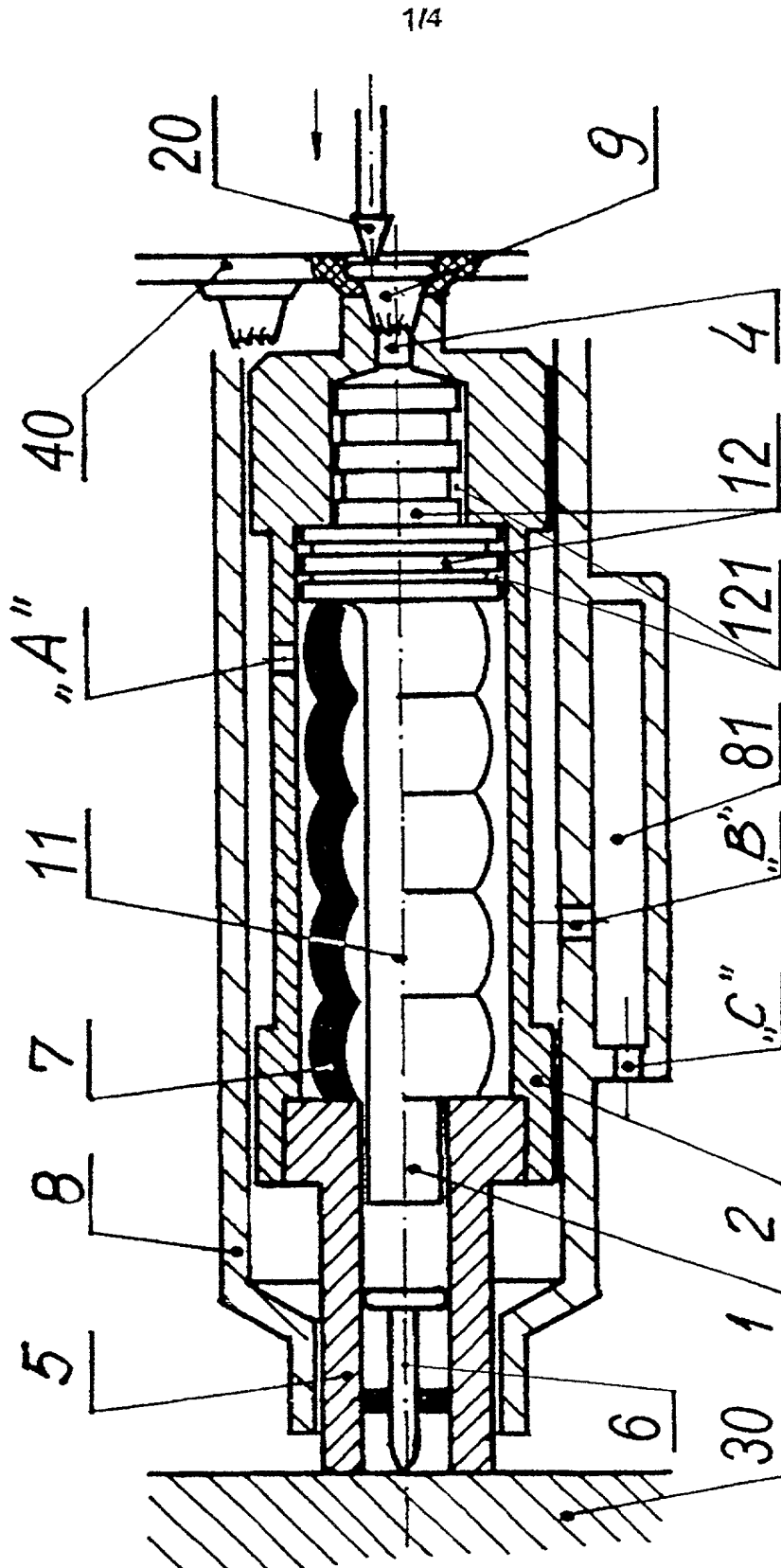


Fig. 1

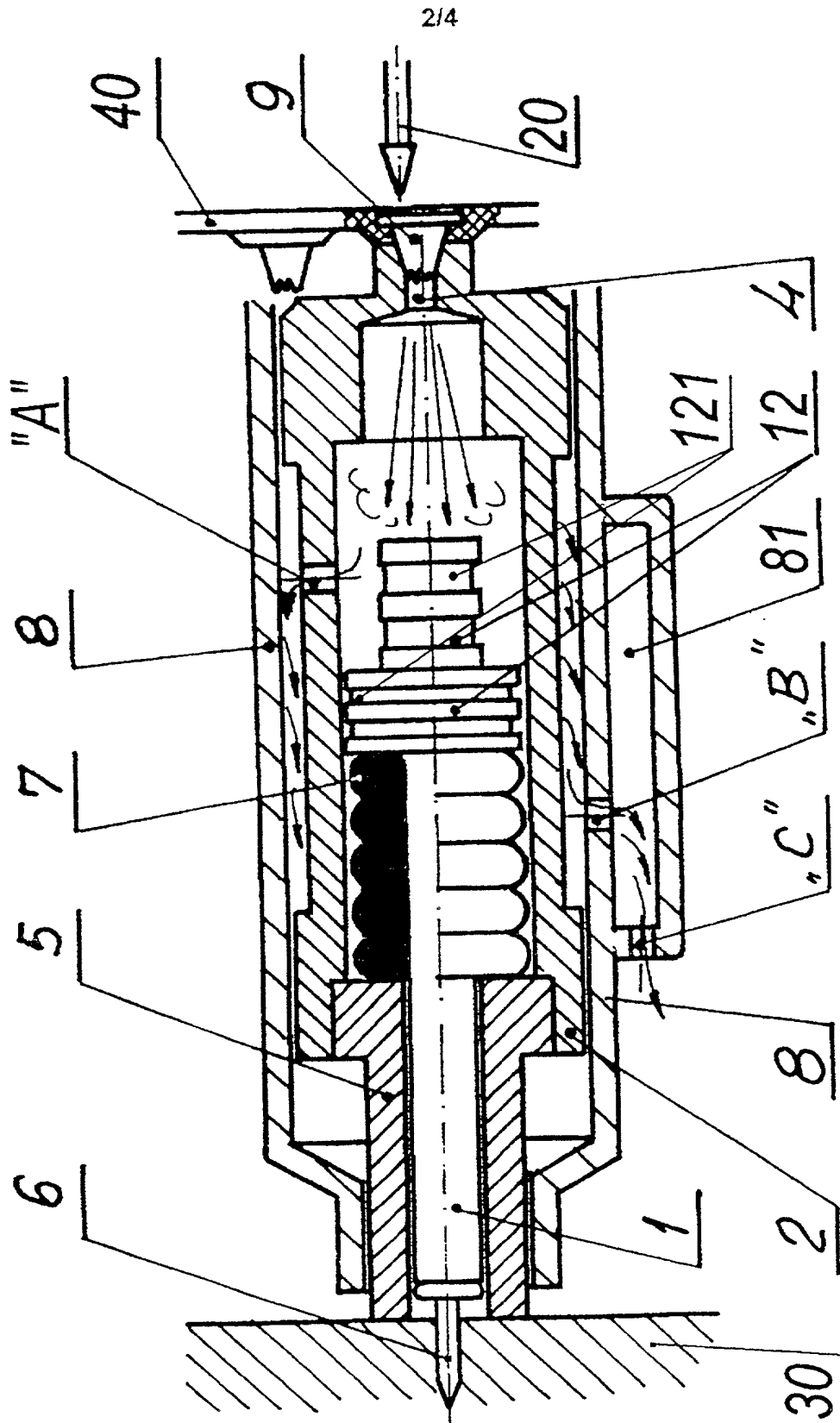
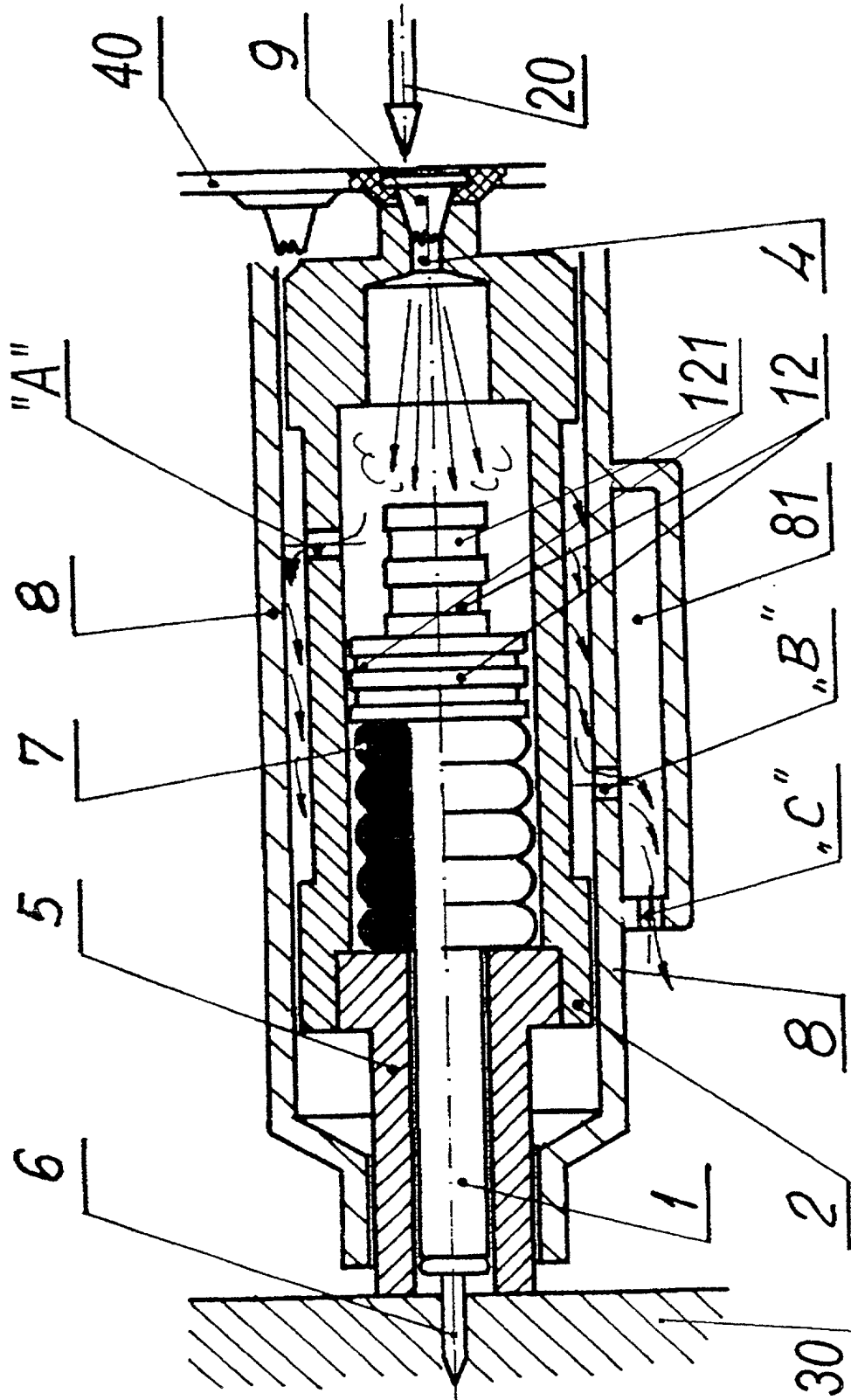


Fig. 2



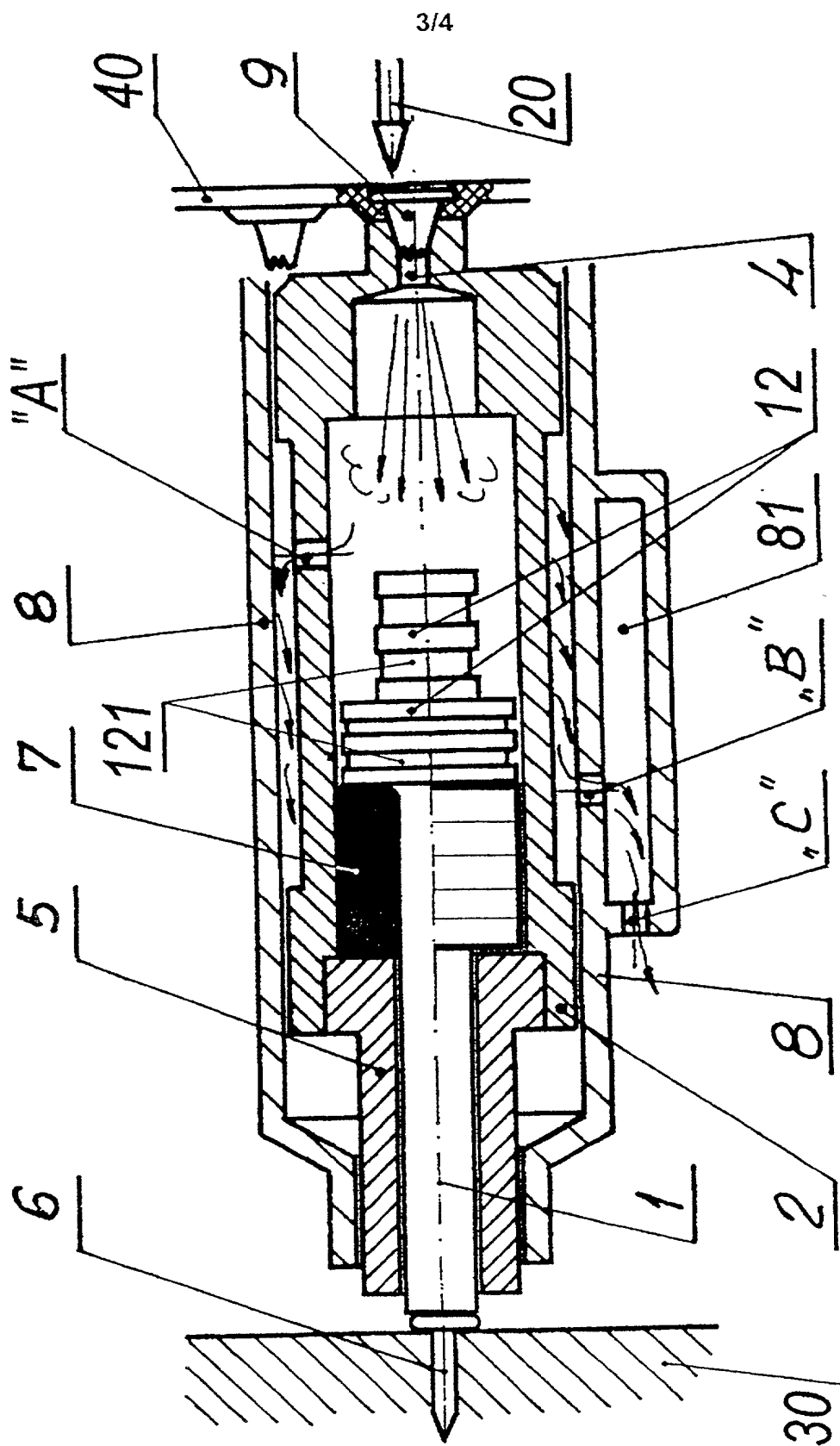


Fig. 3

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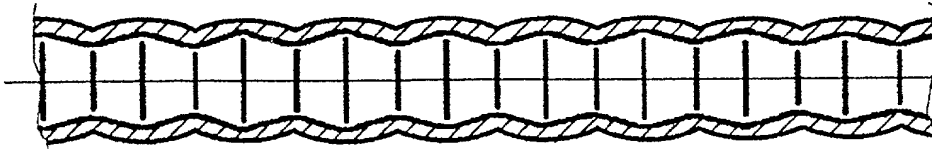


Fig. 4

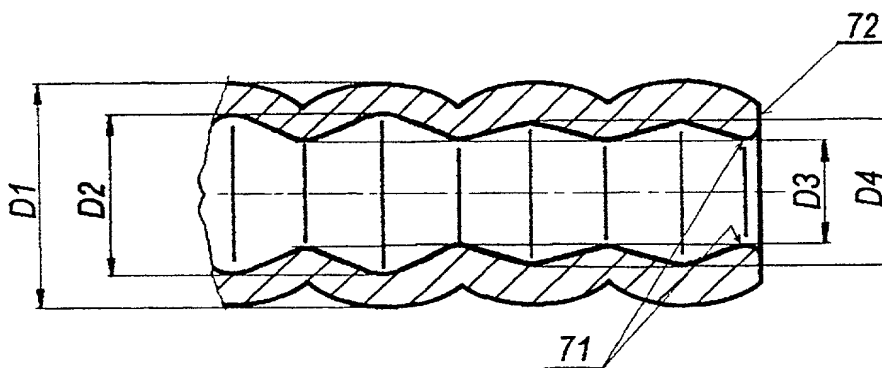


Fig. 5



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<b>DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)</b>	Attorney Docket Number		
	First Named Inventor	Łagodziński Marek	
	<i>COMPLETE IF KNOWN</i>		
	Application Number	/	
	Filing Date		
	Group Art Unit		
<input checked="" type="checkbox"/> Declaration Submitted with Initial Filing      OR <input type="checkbox"/> Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)		Examiner Name	

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**POWER OPERATED PISTON TOOL WITH PISTON  
AUTOMATIC RETURN**

the specification of which (Title of the Invention)

☒ is attached hereto  
OR

☐ was filed on (MM/DD/YYYY) 12/31/1998 as United States Application Number or PCT International

Application Number PCT/PL98/ and was amended on (MM/DD/YYYY)  (if applicable)

I hereby state that I have read and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
P-324361	Poland	01/19/1998	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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[Page 1 of 2]

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I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application

U.S. Parent Application or PCT Parent  
Number

Parent Filing Date  
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon

Name of Sole or First Inventor:

☐ A petition has been filed for this unsigned inventor

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Family Name or Surname

Marek

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Inventor's Signature				Date	30 June 2000
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Country	Poland				

☒ Additional inventors are being named on the 1 supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto

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<b>DECLARATION</b>	<b>ADDITIONAL INVENTOR(S)</b> <b>Supplemental Sheet</b> Page <u>1</u> of <u>1</u>
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Name of Additional Joint Inventor, if any:		<input type="checkbox"/> A petition has been filed for this unsigned inventor					
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Inventor's Signature	<u>[Signature]</u>				Date	<u>June 30 2000</u>	
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<u>Zbigniew</u>				<u>Rogowski</u>			
Inventor's Signature	<u>[Signature]</u>				Date	<u>June 30 2000</u>	
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City	<u>Łódź</u>	State		ZIP	<u>92-413</u>	Country	<u>Poland</u>
Name of Additional Joint Inventor, if any:		<input type="checkbox"/> A petition has been filed for this unsigned inventor					
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Inventor's Signature					Date		
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